Appendix 4
Storm Sewer Pipe Calculations
Conduit Outlet Protection Calculations
Emergency Spillway Calculations

STORM SEWER TABULATION

SHEET 1 OF 3

PROJECT NO.: 18130
LOCATION: BLOCK 33, LOT 21, COUTS NECK
COMPUTED BY: ASG DATE: 4-6-20
CHECKED BY: DATE:

DESIGN STORM FREQUENCY: 25 YEAR
INTENSITY CURVE: NJDEP

LOCATION: STRUCTURE NO.[1] UPSTREAM	DOWNSTREAM	RUNOFF DATA: AREA (Ac)	WEIGHTED RUNOFF COEFFICIENT[3] C̄	A x C̄	TOTAL (ΣA x C̄)	TIME OF CONCENTRATION: OVERLAND THROUGH AREA (T_A) (MIN)	THROUGH PIPE (T_P) (MIN)	ACCUMULATED T_C (MIN.)	RAINFALL INTENSITY (IN/HR)	PEAK RUNOFF Q (CFS)	SEWER DESIGN DATA (PIPE MATERIAL[2] RCP, MANNINGS 'n' 0.013): DIAMETER (INCHES)	LENGTH (FT)	SLOPE (%)	CAPACITY AT FULL FLOW (CFS)	VELOCITY AT FULL FLOW V_F (FPS)	VELOCITY ACTUAL V_A (FPS)	SEWER INVERT (IN)	(OUT)	TG
(1)	(2)	(3)	(4)	(5)=(3)x(4)	(6)=Σ(5)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	
22	21	0.04	0.99	0.04	0.04	10	0.2	10	6.8	0.27	15	25	1.0	6.5	5.3	2.5	—	80.00	83.00
21	19	0.22	0.39	0.09	0.13	10	0.4	10.2	6.8	0.88	15	112	2.57	10.4	8.5	5.0	79.75	79.75	83.00
20	19	0.16	0.68	0.11	0.11	10	0.1	10	6.8	0.75	15	13	1.0	6.5	5.3	3.4	—	77.00	80.00
19	18	0.12	0.77	0.09	0.33	10	0.2	10.6	6.8	2.24	15	84	2.23	9.7	7.9	6.4	76.87	76.87	80.00
18	16	0.16	0.74	0.12	0.45	10	0.2	10.8	6.8	3.1	15	50	1.00	6.5	5.3	5.2	75.00	75.00	78.00
17	16	0.11	0.74	0.08	0.08	10	0.2	10	6.8	0.54	15	50	3.00	11.2	9.1	4.9	—	76.00	79.00
16	15	0.09	0.75	0.07	0.60	10	0.1	11	6.8	4.1	15	24	2.08	9.3	7.6	7.4	74.50	74.50	78.00
15	14	0.48	0.71	0.34	0.94	10	0.3	11.1	6.8	6.4	15	122	1.20	7.1	5.8	6.6	74.00	74.00	77.00
14	13	0.21	.99	0.21	1.15	10	0.3	11.4	6.7	7.7	18	114	1.00	10.5	5.9	6.4	72.54	72.29	77.50
13	12	0.19	.99	.19	1.34	10	0.3	11.7	6.5	8.7	18	102	1.0	10.5	5.9	6.6	71.15	71.15	75.50
12	9	0.07	.99	.07	1.41	10	0.2	12.0	6.2	8.7	18	90	1.0	10.5	5.9	6.6	70.13	70.13	74.60

NOTES 1 – SEE CONSTRUCTION PLANS FOR PROFILE INFORMATION.
2 – PIPE CLASS SHALL BE AS SHOWN ON THE CONSTRUCTION PLANS.
3 – SEE APPENDIX FOR CHARTS AND NOMOGRAPHS USED HEREIN

SHEET 2 OF 3

PROJECT NO.: 18130
LOCATION: BLOCK 33, LOT 21, COLTS NECK
COMPUTED BY: ASG DATE: 4-6-20
CHECKED BY: DATE:

DESIGN STORM FREQUENCY: 25 YEAR
INTENSITY CURVE: NJDEP

LOCATION: STRUCTURE NO.[1] UPSTREAM	DOWNSTREAM	RUNOFF DATA: AREA (Ac)	WEIGHTED RUNOFF COEFFICIENT[3] C	A x C	TOTAL (ΣA x C)	TIME OF CONCENTRATION: OVERLAND THROUGH AREA (TA) (MIN)	THROUGH PIPE (Tp) (MIN)	ACCUMULATED Σ (MIN.)	RAINFALL INTENSITY (IN/HR)	PEAK RUNOFF Q (CFS)	SEWER DESIGN DATA: PIPE MATERIAL[2] RCP MANNINGS 'n' 0.013: DIAMETER (INCHES)	LENGTH (FT)	SLOPE (%)	CAPACITY AT FULL FLOW (CFS)	VELOCITY AT FULL FLOW V_F (FPS)	VELOCITY ACTUAL V_A (FPS)	SEWER INVERT (IN)	(OUT)	TG
(1)	(2)	(3)	(4)	(5)=(3)x(4)	(6)=Σ(5)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	
11	10	0.18	.25	.05	.05	10	0.1	10	6.8	0.34	15	65	0.5	4.6	3.7	2.1	—	68.23	71.00
10	9	0.12	.99	.12	.17	10	0.5	10.1	6.8	1.16	15	84	0.5	4.6	3.7	3.1	67.96	67.90	70.90
9	6	0.16	.99	.16	1.74	10	0.2	12.2	6.2	10.5	18	82	1.38	12.3	7.0	7.7	67.48	67.23	71.00
7	6	0.16	.80	.13	.13	10	—	10	6.8	0.88	15	12	7.1	17.2	14.1	8.1	—	67.00	70.00
8	6	0.15	.99	.15	.15	10	—	10	6.8	1.0	15	101	3.3	11.8	9.6	5.7	—	69.50	72.50
6	HW 5	0.31	.69	.21	2.02	10	—	12.4	6.2	12.5	18	20	2.0	14.8	8.4	9.4	66.15 65.90	65.90	70.00
HW 5																	65.50		

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SHEET 3 OF 3

PROJECT NO: 18130
LOCATION: Block 33, Lot 21, Coutsneck
COMPUTED BY: ASG DATE: 4-6-20
CHECKED BY: DATE:

DESIGN STORM FREQUENCY: 25 YEAR
INTENSITY CURVE: NJDOT

LOCATION: STRUCTURE NO.[1] UPSTREAM (1)	DOWNSTREAM (2)	RUNOFF DATA: AREA (Ac) (3)	WEIGHTED RUNOFF COEFFICIENT[3] C (4)	A x C (5)=(3)x(4)	TOTAL (ΣA x C) (6)=Σ(5)	TIME OF CONCENTRATION: OVERLAND THROUGH AREA (T_A) (MIN) (7)	THROUGH PIPE (T_P) (MIN) (8)	ACCUMULATED T_C (MIN.) (9)	RAINFALL INTENSITY (IN/HR) (10)	PEAK RUNOFF Q (CFS) (11)	SEWER DESIGN DATA (PIPE MATERIAL[2] RCP, MANNINGS 'n' 0.013): DIAMETER (INCHES) (12)	LENGTH (FT) (13)	SLOPE (%) (14)	CAPACITY AT FULL FLOW (CFS) (15)	VELOCITY AT FULL FLOW V_F (FPS) (16)	VELOCITY ACTUAL V_A (FPS) (17)	SEWER INVERT (IN) (18)	SEWER INVERT (OUT) (19)	TG
27	26	0.47	.25	0.12	0.12	10	0.3	10	6.8	0.82	15	70	2.86	10.9	8.9	4.2	—	79.50	82.50
26	25	0.21	.85	0.18	0.30	10	0.3	10.3	6.8	2.0	15	110	3.18	11.5	9.4	7.1	77.50	77.50	80.50
25	24	0.49	.93	0.46	0.76	10	0.3	10.6	6.8	5.2	15	134	1.49	7.9	6.4	6.8	74.00	74.00	77.00
24	HW23	0.15	.99	0.15	0.91	10	—	10.9	6.8	6.2	15	83	6.63	16.7	13.6	12.5	72.00	70.00	76.50
HW23																	65.50		
																			RIM
OS 4	MH3								*	2.36	15	70	5.00	14.5	11.8	9.2	65.50	65.50	—
MH3	MH2								*	2.36	15	35	10.00	20.5	16.7	10.9	62.00	55.50	65.0
MH2	HW1								*	2.36	15	40	10.00	20.5	16.7	10.9	52.00	47.00	55.0
																	43.00	43.00	

NOTES 1 – SEE CONSTRUCTION PLANS FOR PROFILE INFORMATION.
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3 – SEE APPENDIX FOR CHARTS AND NOMOGRAPHS USED HEREIN

* 100 YEAR ROUTED OUTFLOW

Appendix 5
GSR-32 Groundwater Recharge Analysis Spreadsheet

New Jersey Groundwater Recharge Spreadsheet Version 2.0 November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
MONMOUTH CO., COLTS NECK TWP	45.2	1.45

Project Name:	Colts Neck Community Church
Description:	Colts Neck, NJ
Analysis Date:	07/20/20

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.68	Open Space	Freehold	13.6	33,455
2	0.1	Gravel, dirt	Freehold	8.8	3,180
3	7.07	Open Space	Tinton	15.6	400,208
4	0.38	Woods-grass combination	Tinton	14.9	20,519
5	0.72	Impervious areas	Tinton	0.0	-
6	0.05	Gravel, dirt	Tinton	13.4	2,432
7	0.35	Open Space	Colts Neck	13.6	17,309
8	0.04	Impervious areas	Colts Neck	0.0	-
9					
10					
11					
12					
13					
14					
15					
Total =	9.4			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				14.0	477,101

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.56	Open space	Freehold	13.6	27,552
2	0.05	Impervious areas	Freehold	0.0	-
3	6.25	Open space	Tinton	15.6	353,789
4	2.1	Impervious areas	Tinton	0.0	-
5	0.4	Open space	Colts Neck	13.6	19,781
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
Total =	9.4	Warning: make total area equal to Pre-Developed Condition		Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				11.8	401,122

Annual Recharge Requirements Calculation ↓		
% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft) 93,654
Post-Development Annual Recharge Deficit=	***75,979***	(cubic feet)

Recharge Efficiency Parameters Calculations (area averages)					
RWC=	2.47	(in)	DRWC=	2.47	(in)
ERWC =	0.68	(in)	EDRWC=	0.68	(in)

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Project Name	Description	Analysis Date	BMP or LID Type
Colts Neck Community Ch	Colts Neck, NJ	07/20/20	Infiltration Basin

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	8272.6	sq.ft
BMP Effective Depth, this is the design variable	dBMP	1.8	in
Upper level of the BMP surface (negative if above ground)	dBMPu	-42.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	0.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	1	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	1.58	in
ERWC Modified to consider dEXC	EDRWC	1.58	in
Empty Portion of RWC under Infilt. BMP	RERWC	1.28	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.16	in
Inches of Rainfall to capture	Pdesign	0.23	in
Recharge Provided Avg. over Imp. Area		2.8	in
Runoff Captured Avg. over Imp. Area		11.0	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.09	unitless
BMP Volume	VBMP	1,265	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> Solve Problem to satisfy Annual Recharge
dBMP Check—> OK
dEXC Check—> OK
BMP Location—> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	75,979	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	93,654	sq.ft
Root Zone Water Capacity	RWC	5.74	in
RWC Modified to consider dEXC	DRWC	5.74	in
Climatic Factor	C-factor	1.45	no units
Average Annual P	Pavg	45.2	in
Recharge Requirement over Imp. Area	dr	9.7	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		22,179	cu.ft
Avg BMP Recharge Efficiency		25.7%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.8%	%
%Runoff Infiltrated		31.4%	%
%Runoff Recharged		8.1%	%
%Rainfall Recharged		6.3%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.
To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration clik the "Default Vdef & Aimp" button.